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ENVIRONMENTAL ISSUES OF CRITICAL IMPORTANCE
RELATING TO THE SUBJECTS OF THE CONFERENCE (DRAFT)

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INTRODUCTION

1. The purpose of the present paper is to highlight the major environmental issues (some of which have already become critically important at the present stage) relating to the discussion subjects of the Conference. Studies on problem-sectors and problem-areas (series D and E) as well as discussion papers (series F and G) to be presented at the Conference served as the main basis on which the following text has been developed. Complementary information was sought in other Conference documentation - except for country monographs in series B of which a separate review has been issued by the Secretariat in document ENV/CONF/C.4. Moreover, views on certain problems were requested from the various Divisions within the ECE Secretariat.
2. While the present brief review of environmental issues is intended to proceed subject by subject, as listed in the programme of the Conference, it will be selective and no attempt will be made to go into detail or to cover systematically all major problems relating to the subjects concerned. Neither the space available in this document nor the documentation background for the Conference would be sufficient for this purpose. Furthermore, no claim is made for classifying the environmental issues according to their relative importance since this may vary a great deal between the individual countries and areas. Rather, this paper is intended to provide delegates at the Conference with some guidance concerning the discussion of the individual subjects and the formulation of possible conclusions and/or recommendations thereon.
3. An explanation would seem appropriate in this introduction as regard the selection and listing of the subjects of the Conference for which the pattern was set by the Preparatory Group and is reflected in the layout of the present paper. It will be noted that, in its first part, the programme of the Conference has been focused on environmental problems generated in the various problem-sectors of the economy and encountered in different types of geographical problem-areas. This approach was decided upon because it was thought that it might facilitate identifying governmental responsibility regarding environment, which is split among central sectoral ministries and local government departments responsible for geographical areas. It was hoped that, in this way, the ground would be efficiently prepared for a stimulating exchange of views on environmental policy and action through, or with the help of, the governmental machinery; discussion subjects serving this purpose were envisaged in the second part of the programme of the Conference.

A. PROBLEM SECTORS

I. Energy production

(D.1 and D.1/1; see, also, for example, E.4 and H.7; for health aspects, see H.5; for hydro-electric power systems see H.10 and for rehabilitation of mining areas, H.8 and J.1) 1/

4. Some of the main basic facts underlying considerations as to environmental risks borne by energy production are that (i) this fundamentally important sector was and still is responsible for some of the very worst environmental nuisances; (ii) demand and, consequently, production of energy is expected to increase rapidly; (iii) various facilities serving the generation and transfer of power are widely spread over the inhabited environment, and their interference with the environment cannot therefore be said to be limited to certain industrial areas only.

5. Environmental disfunctions attributed to energy production proper generally include, in the main, (i) air pollution caused by solid exhalations (fly-ash, dust, soot) and by gaseous exhalations affecting both organisms and constructions (sulphur compounds, nitrogen oxides etc.) and (ii) water pollution caused mostly by abiotic wastes and heat. Moreover, where solid fossil fuel is fired, unsightly heaps of stored coal or coal powder and of deposited ash are a frequent occurrence and pollute the soil. Although hydro-electric power generation is clean, water retention dams disturb the ecological balance, provoke changes in the underground water horizons, the cooling-down of water downstream, and sometimes also geological effects. Much discussed have been environmental threats caused by power plants involving nuclear fission where, owing to radiation, the problems of siting and of waste disposal have become of paramount importance. Disturbing environmental disfunctions are also caused by local heating based on solid fuels which still prevails in many regions. This may have some quite noxious effects on human health and on the various components of constructions in areas where population, housing and smallscale industry are densely located and where fuel of poor quality is used.

6. In connexion with energy production, as well as with other industrial production, specific disfunctions deserving mention are those caused by coal-mining, by drilling for oil and by the production of coke and gas as primary sources of energy; land

1/ The series and number of reference documents on the relevant subject is given in parentheses. Normally, these indices are preceded by the symbol ENV/CONF/...

dereliction caused by subsidence of the soil or by opencast workings; the dumping of waste minerals and slag; water pollution by oil; air pollution caused by the self-ignition of debris, etc. salinity of surface waters due to coal-mining has also been evoked.

7. Finally, mention should be made of the aesthetic nuisances and eyesores caused in some cases by badly located and unsightly power plants and auxiliary facilities, by high-voltage power lines, gas- and oil-pipelines, the latter also reportedly disturbing the habits of wildlife.

8. Although, in general, environmental disfunctions generated in the process of energy production can be considered as serious, they vary considerably according to the primary resources used, the production methods, technology and siting of power plants. While heavy damage to the environment has been entailed by traditional methods of energy production caused by the firing of coal of low calorific value where the application of efficient anti-pollution measures has not proved economically feasible, the use of gaseous and liquid fuels, in combination with modern technology for fuel and energy production, may considerably reduce environmental risks.

9. Where clean fuel and advanced technology are not available or are expensive, an appropriate siting of power plants (in relation to densely populated zones and areas of agricultural and biological value - taking into account the direction of the predominant winds) may be of some help; although only a relative improvement, some temporary relief and the shifting of problems from more to less sensitive areas may thus be achieved.

10. It is hoped that considerable improvement in the state of the environment may be achieved in the more distant future when other or more advanced systems of power generation have developed. Modern fission power plants seem to have already reached a stage of development where the risks of radiation and of the ensuing environmental damage have been reduced to a very satisfactory minimum. While still in the advanced-research stage, controlled fusion power would appear to offer important environmental advantages.

11. Efficient environmental action within the energy sector requires that a comprehensive set of measures be brought into effect encompassing all major phases of the production process: the production of energy resources, the production of energy in itself, as well as the transfer and consumption of energy. Apart from general legislative measures and regulations on national and, possibly, international levels

(concerning, for example, environmental-quality standards for fuels and fuel transportation; for power lines and pipelines; for emissions, effluents and radiation, etc.), specific regional and local measures will be needed to take care of the rehabilitation of mining areas, the restoration and protection of the ecological balance in centres of energy production, the reduction of local pollution by means of the modernization of out-dated plants, etc. Physical planning may serve as an efficient means of control wherever problems of the location of power plants arise. On all levels, economic incentives encouraging the clean production of energy will be of help. The construction of new power plants and of new power distribution systems should be brought under strict environmental supervision.

12. Stimulation of research relating to the most critical phases of energy production and focused, for example, on the desulphurization of fuel and of gaseous exhalations, on techniques for the dispersal of emissions, and on the problems of waste heat and cooling, would seem generally useful. Research on the environmentally-safe disposal of radioactive nuclear waste is another subject of compelling importance. Complementary to environmentally protective measures to be applied in the process of energy production, ways and means should be studied to determine how the energy produced could be more efficiently used for an active protection and improvement of the environment. Special measures should be applied in energy production and distribution systems in order to meet aesthetic requirements as regards landscaping.

13. Attention is drawn, inter alia, to the Recommendations concerning the elimination of sulphur oxides adopted by the ECE Working Party on Air Pollution (Geneva, January 1971), and to a sizeable number of ECE studies concerning the desulphurization of fuel and combustion gases. Attention is also drawn to the basic international standards which are available in the field of nuclear energy production and which deal with nuclear as well as with non-nuclear effluents.

II. Metal industry

(D.2; see also H.7; for industrial effluents and refuse, see D.6; for health aspects, see H.5).

14. Although various types of metallurgic enterprises exist, ranging from smaller-scale units traditionally implanted in mixed and industrial urban areas, to more or less isolated and self-contained giant plants, the process of extracting the metal from the ore and of transforming it causes special environmental problems common to virtually all of these types. Environmental dysfunctions arise mainly in connexion

with (i) the enormous consumption (and discharge) of water, air and energy during the process of metal production, (ii) the manipulation of ores and fuel and of the slag separated during the reduction of the ore, and (iii) the transformation of raw ingots into semi-products. The actual disfunctions may, however, differ a great deal depending upon the size and location of the plant, the system of transportation, unloading and storage of ore, the disposal of waste residuals, the technology and the power resources used.

15. There are a few areas in the ECE region where, because of an extraordinary and ever growing concentration of metallurgic and related production units, environmental disfunctions arise of an exceptional complexity and scale. Some of the disfunctions must be attributed to energy production and to the extraction of energy-producing raw materials which frequently occur in the vicinity of, for example, steel works. Although the sources of major environmental disfunctions arising in connexion with metal production are thus concentrated locally and are confined to a limited number of industrial agglomerations, the impact of such disfunctions is felt over much larger territories and often goes beyond national boundaries. Indeed, environmental problems caused by the metal industry, together with energy production, can be said to belong to those giving rise to international problems.

16. Air pollution and water pollution seem to head the list of problems. Apart from those mentioned under energy production (see section I), the specific contributors to air pollution include, for example, dust and waste gases from sinter plants, red fumes from oxygen-blown converters and from electric arc furnaces, fluorine compounds and chlorine emitted from aluminium plants, sulphites, sulphates and acids. Fluorine compounds have recently been recognized as being particularly noxious to human health, plants and animals. Water pollution and soil pollution from metal industries are partly the results of efforts to reduce air pollution by treating gaseous effluents and separating dust. It seems of some advantage to the biologic life in waters that water pollution caused by the metal industry is prevailingly by inorganic matter and waste heat; if quantities of these pollutants are not excessive, they are considered as having relatively little effect on the oxygen balance in water. However, the solids suspended in polluted water have a strong tinting effect.

17. Noise constitutes a nuisance caused mainly during shaping operations by, for example, high-speed blowers, by metallic plates dropped on roller tables, by forging hammers, etc. Such noise affects workers employed in these processes. The loading of railway wagons and other noise caused by the transport of heavy metallurgic products also constitute environmental nuisances. Outside of metallurgic plants, complaints against the noise caused by them seem to be relatively rare and may relate mainly to occasional excessive noises (by safety valves, etc.). Slag residuals requiring appreciable portions of land for dumping may present acute problems in metallurgic zones where land for further development is scarce.

18. Environmental action aimed at eliminating disfunctions generated in the metal industry sector necessarily focuses on the prevention of air and water pollution, the sources of which can mostly be well defined and delimited. It is felt that greater attention would need to be given to the toxicity of certain dusts and gases. The elimination of toxic effects in the emission of certain metal compounds and of fluorine is reported to be a prominent objective of endeavours in the non-ferrous metal industry; the reduction of fluorine emissions in the production of primary-aluminium pig would seem especially urgent in this respect. Research programmes aimed at combating dust have been announced. Further research will be needed in order to permit a more efficient reclamation of chemical substances used metallurgic processes (sulphur, phenol from coking plant waste water) and the conversion of, for example, the cyanide and hydrogen sulphide into less detrimental compounds. Another urgent problem for research is to find methods for reducing noise in metal shaping processes where current noise control measures cannot be applied, and thus to eliminate the danger of loss of hearing to the workers involved. A number of problems remain to be solved relating to the utilization and pollution of water, in respect of, for example: the biological treatment of coking plant waste water; the purification of waste waters from floatation plants; the perfecting of water recirculation and of closed circuit systems; the treatment of waste water produced in top gas cleaning. In many of these research projects, harmonization of efforts and international co-operation would be recommended.

19. Physical planning deserves attention as a tool for controlling the location and spatial development of metallurgic plants. Environmental nuisances can be considerably reduced by, for example, an appropriate separation or isolation of such processes in space.

III. Chemical and petrochemical industry

(D.3; see also H.7); for individual effluents and refuse, see D.6; for effects of chemicals, see D.7 and for health aspects, H.5).

20. The chemical industry includes a wide array of enterprises of very different sizes, types of products, and location. It is one of the biggest industrial consumers and polluters of water, mainly by synthetic organic pollutants. Whereas the majority of enterprises may be considered as fairly evenly distributed throughout urbanized areas and their industrial zones, huge chemical agglomerations are concentrated in a relatively small number of areas where energy, chemical raw materials and water are abundant. It is in these areas that environmental damage often reaches a high degree of complexity and becomes a real threat to human health as well as to many biotic and abiotic environmental components.

21. One of the environmental impacts typical of the chemical industry is the direct emission and discharge of specific toxic materials of a quite varied nature, materials which are often persistent in nature. This industry is, in addition, responsible for producing chemicals many of which are environmentally "active". While some of them have been developed enabling the neutralization of certain pollutants, many others, when consumed or used in various sectors of human activity, have contaminating and other serious adverse effects on human health and environment. Such effects have given rise to serious doubts about the benefits yielded by the production and by the use of certain chemicals; a thorough re-examination of the positive and negative aspects of the contribution of this industry to economic growth and human welfare would seem advisable.

22. The environmental disfunctions considered as most serious in the chemical industry include:

- atmospheric pollution caused by the emission of hydrocarbons and their derivatives (chlorinated hydrocarbons are given as examples of very stable and persistent organic synthetic compounds); carbon monoxide; hydrogen sulphide and carbon disulphide; sulphuric anhydride; oxides of nitrogen and sulphur; chlorine and

fluorine compounds; metallic pollutants such as manganese, chromium, lead, cadmium and mercury; carbon and other dust; and malodorous substances;

- water pollution by chemicals of diverse composition (including, for example, petroleum products, acids, salts, alkali sulphides, mercaptans, ammonia, phenols - the latter serving as an example of toxic products which cannot be easily decomposed by bacterial methods), and by suspended solids;
- soil pollution due to leakage of oil, mineral dust, etc.;
- food pollution;
- increased danger of fire and explosion.

23. Secondary environmental effects generated by the chemical industry can be considered as those arising when chemical products are used; for example, by burning fuel in combustion engines (see also section V), by using detergents, herbicides, pesticides and fertilizers. Non-degradable plastic bottles and other containers have become a special problem in this category.

24. The chemical industry is severely controlled by health services because of the serious health risks, work accidents and professional diseases it entails. However, the rapid evolution of this type of production creates new risks, some of which can be identified only after a relatively long period. Because of the many toxic materials manipulated in the chemical industry, accidents can have quite spectacular repercussions within a wide radius. For these reasons, continuous research, testing and long-term observation of the effects on the environment of chemical production and chemical products would seem to be of particular importance.

25. More specifically, recommendations have been registered to:

- develop more efficient decontamination installations eliminating toxic substances in gaseous emissions and effluents at the source;
- encourage the introduction of air-tight equipment, clean fuel, leak-proof storage tanks for chemicals and of electric dust separators;
- develop the special chemical treatment of fuel gases by which pollutants could be converted into re-utilizable by-products;
- introduce closed circuits of water used in production processes and replace water cooling by air cooling;
- further develop industrial methods for absorbing oxides of nitrogen, sulphur gases, hydrogen sulphide and carbon monoxide;
- develop new methods for removing dust particles and aerosols from the air;

- study methods for separating phenols from waste water, and for desalinating waste water;
- encourage the production of degradable plastics, detergents, etc.;
- encourage the creation of "zero-discharge" enterprises with a complete absence of waste disposals.

26. Special planning and organizational measures should be available enabling the planning and construction of environmentally-safe chemical factories and, in cases of need, the switching from a dangerous type of production to a less harmful one; these measures ought to promote the development of green protection belts around chemical factories and of joint purification stations serving groups of chemical enterprises..

27. In developing environmentally protective measures, co-operation between industry and governments would be of particular importance for this sector, and the exchange of information on the effects of new chemical products should be fostered. For the exchange of experience regarding action against chemical pollutants see, for example, reports such as that on microchemical pollutants (document ENV/CONF/H.5, paragraph 7).

IV. Building and related industries^{2/}

(D.4; H.1/Add.2 (Russian only) and H.2 (English only))

28. In the building industry, distinction must be made between environmental nuisances accompanying the production of building materials and the process of construction - as against those which might be called indirect or secondary effects and are caused by the building products themselves. While the former disfunctions are of a predominantly temporary nature, the latter are often much more stable and, for the over-all quality of the environment, much more important. Indeed, it has not always been fully realized that most of the total sum of elements constituting the built, artificial human environment - which is perceived and exploited by man and which exercises an undeniable influence on his behaviour, habits and feelings - has been created by the building industry and not by the user himself (at least not in industrialized countries). While, therefore, it can hardly be an exaggeration to say that the building industry is the one which most actively changes and creates the

^{2/} Only construction industry and the production of building materials are dealt with in the present section. However, public works which are closely related to building industry ought also to be mentioned as having a significant impact on environment. Their management by public authorities should be considered as a significant factor in this respect.

environment, it is doubtful whether this industry is sufficiently qualified to carry the appropriate responsibility in this respect. Although many psychological and hygienic considerations have traditionally formed part of the design and construction process, a comprehensive environmental approach to the development of new components and zones of the built environment is still in an exploratory stage.

29. Consequently, two distinct categories can be identified regarding environmental disfunctions which arise as a consequence of the process of building:

- (i) disfunctions arising in the course of the production of building materials and of construction: noise (caused by transportation, by the use of building machines and of metallic constructions), explosions, tremors, vibrations, etc.; excavations left after the extraction of building materials; air pollution by dust and burnt fuels; to a lesser degree, water pollution (timber industry, inorganic matter from quarries); soil pollution; the soiling of roads and of the surroundings of extraction and construction sites, devastation of nature; and the destruction of old valuable built elements and amenities;
- (ii) disfunctions caused by the products of the building industry, i.e., by buildings and various other constructions; misuse of space by excessively high and dense buildings; eyesores caused by constructions of poor quality and by the structural incompatibility of individual buildings; defective spatial and functional relations among built structures; lack of natural elements in built-up areas; visual offence due to a lack of maintenance and to dilapidated buildings; poor climatic qualities (shade, draughts of air), etc.

30. As far as remedial action is concerned, a number of measures might be developed or strengthened relating to the various branches of the production of building materials. Among such measures, dust-proofing in cement production and the silencing of machines used in construction seem to be of high priority. Furthermore, more systematic and efficient measures should be taken concerning the recultivation of sand, gravel and clay pits and stone quarries (filling, planting and landscaping of excavations, etc.).

31. Another set of measures where environmental protection should be stressed relates to the "behaviour" of the construction industry on building sites, particularly in densely populated urban areas. Environmental requirements should be fully reflected in, for example, regulations regarding the transportation of building materials, safety on building sites and protection of neighbouring areas, constructions and activities.

As has been stressed, some of the primary environmental disfunctions caused by construction activities can be reduced by the industrialization of production whereby disturbances frequently occurring at building sites, such as dust, can be considerably reduced. Industrial construction methods may reduce considerably the period of construction and, thus, the duration of nuisances and disorders in the areas under development.

32. Further research will be needed as regards the secondary or indirect environmental implications resulting from the expansion of the built environment. In both the functional and aesthetic considerations regarding the siting, shaping and grouping of built structures, more room should be given to comprehensive environmental aspects and investigations. Environmental interests can be considerably reinforced by the setting out and application of positive planning measures. Further research would also be required regarding the interaction between the internal and external environments of buildings, the mutual influence between the built structures and the local climate, the isolation of buildings against noise and vibrations, the impact of various building materials on environmental quality, etc.

V. Transportation

(D.5; for health aspects, see H.5)

33. The increase in the variety and number of transportation means and facilities during the past decade has proceeded conjointly with the spectacular intensification in traffic all over the globe and in intensively urbanized areas, the augmentation of travel mileage per head of population and the increased amount of transport required for the manufacturing and distribution of consumption goods. The environmental disfunctions arising in connexion with transportation have intensified accordingly.

34. They can be ranged under three main categories:

(i) disfunctions caused by "moving" transport:

- noise (in this respect, of a critical importance seems to be any significant noise produced at night; noise with peaks exceeding 95 PN-dB^{3/} at any time; noise at higher frequency levels, and bangs caused by aircraft flying at supersonic speed);

3/ PN = Perceived Noise.

- vibrations inside vehicles;
- air pollution and contamination by many types of chemical compounds emitted in the form of gases and solid particles from exhaust pipes, crank cases, carburettors and fuel tanks; hydrocarbons, carbon monoxide, oxides of nitrogen, "photochemical" oxidants including ozone; lead compounds, visible smokes, unburnt petrol and malodours; also the dust which is still raised from some roads is an unpleasant pollutant. The intensity and toxicity of pollution will depend very much upon the meteorological conditions, the average traffic speed, the density of traffic, the proximity of residences, the fuel used, the age and state of vehicles and engines, the types of engines, etc.;
- the transport of dangerous goods.

(ii) disfunctions caused by "stationary" traffic:

- water pollution by oil and petrol;
- deterioration of environmental quality, mainly in urban areas, owing to excessive space consumption by parking spaces to the detriment of other urban functions, and owing to the unorganized disposal of junk cars;

(iii) disfunctions caused by built and fixed transportation facilities, i.e., by railway stations and tracks, airports and airport runways, road networks, etc.;

- elimination of natural environmental elements and augmentation of concrete and other sterile surfaces;
- creation of noisy, smoky and dangerous zones penetrating all parts of the populated environment.

35. Appropriate consideration should be given to the manifold means of remedial action which exist or are contemplated, regarding environmental nuisances generated by transportation. For example, as regards

(i) the abatement of noise:

- more attention should be paid to the improved sound-proofing of engines and vehicles; to the increased fluidity of traffic flows; to physical separation between transportation spaces, on the one hand, and residences, offices, schools, hospitals and other populated zones on the other hand

(by means of, for example, increased isolation spaces, greenery, fixed solid barriers, underground transport corridors, level differentiation, etc.); to the reduction of the density of transportation flows (through emphasis, inter alia, on efficient mass transit); to the sound-proofing of constructions;

- the abolition of supersonic flights for which international agreements would now seem most appropriate;

(ii) the abatement of air pollution:

- high priority will have to be given to the further development and progressive introduction of pollution-free engines and of pollution-safe fuels; this should also relate to inland vessels and to railway traction where coal-fired engines should eventually be completely eliminated;
- spatial separation of heavily frequented traffic lines should be systematically pursued and conditions for efficiently reducing the heavy concentrations of fumes on such lines should be encouraged;

(iii) the abatement of water pollution:

- the emphasis should be on leak-proof oil and petrol storage, regulations regarding the handling of these substances, obligatory collection of disused oil from engines, etc.; in the latter respect, measures should be urgently developed, especially as regards inland navigable waterways; recipients of oil and petrol wastes should be installed at suitable places.

36. In order to make environmental action in the field of transportation efficient, the measures introduced should be comprehensive and sufficiently complementary to avoid the shifting of nuisances from one transportation means or area to another. The role of physical planning should be seen here as that of a suitable means for considerably reducing environmental nuisances, for example, by an appropriate spatial distribution of the various activities and of the transportation links needed.

37. As regards the transportation of dangerous goods, the measures already taken have environmental importance. It would therefore be of advantage if the European agreement on the transportation of dangerous goods by road could be ratified by as many governments as possible, and if the draft agreement on inland navigation could enter into effect as soon as possible.

VI. Waste management

(D.6 and D.6/Corr.1 (the latter in English only); for wastes in general, see also E.3/1 and G.4/Add.1; for radioactive wastes see D.1/1; for liquid wastes D.3 and J.3; for health aspects, H.5)

38. Affluence and waste go hand in hand. Contrary to other sectors of industry where increased production of goods is the aim, waste management is predestined to eliminate the negative consequences of their growing consumption by manipulating and removing waste in an organized and efficient manner. The need for the waste management sector would be much less if, in accordance with various proposals made, both production and consumption were geared towards reducing, instead of increasing, waste by means of more sophisticated manufacturing and recycling techniques, by an increased durability of products, by their prolonged use, simplified sale and return, more systematic repair and maintenance, etc. However, as long as the increased consumption of material and products per capita remains more profitable than economizing material consumption and switching economic reserves in favour of environmental goods, the role of waste management, in both cleaning the environment from waste and reconverting waste, wherever possible, into raw material again, will increase.

39. Environmental problems arise through the undue disposal of waste and through its accumulation in inappropriate places. This happens largely because little or no material value is attributed to waste and because its conversion into re-utilizable products of raw material is deemed uneconomic. Waste discharged or disposed of in an inappropriate way creates environmental dysfunctions depending on the variegated nature and type of waste. In the narrower sense, the problem-sector is delimited by solid waste:

- (i) refuse made up of household and trade wastes when transformed into litter or when inappropriately treated and disposed of, causes hygienic problems and eyesores and sometimes, also, danger to security (ash, cinders, etc.). These nuisances can reach critical stages in areas of very high population density; organized storage of refuse at the source and a controlled municipal collection and disposal (tipping, incineration, pulverization, pre-compaction) become ever more important for environmental quality as the volume of refuse per capita progressively increases;

(ii) industrial wastes which are of a much wider variety (and are sometimes produced locally in very large quantities) cause still more serious problems particularly where municipal control of their disposal is weak. Among the most criticized nuisances caused by improperly treated industrial waste, mention should be made of the contamination of surface and underground waters by nitrates, chlorides, sulphates and carbonates which threaten public water supplies. Malodours and unsuitable siting of tips should also be taken into account.

40. In a broader sense, waste also includes liquid and gaseous wastes and heat. When compared with solid wastes, the impact of which is mostly limited to local areas, liquid and gaseous wastes are much more expansive, since water and air serve, as a rule, as their recipient and transportation medium. Some inter-relation may be observed between solid and other wastes: by pulverizing or incinerating solid wastes, conditions are created whereby they may pollute water or air. Conversely, purification of water from wastes may contribute to the amount of solid wastes. Industrial and agricultural effluents are the main sources of environmental nuisances from liquid waste. Farm waste has become a significant pollutant with the increasing concentration of animal husbandry.

41. An efficient management of waste ought to be conceived as an integrated process of treating all types of waste. For liquid wastes, their efficient interception and treatment at the source and/or in public sewage works has become ever more indispensable and should be considered as an organic phase of any production chain or of any activity having as a by-product liquid wastes discharged into water streams. The perfecting of the treatment and recycling of the effluents and the utilization of sewage sludge would require increased attention at the research level. By advanced planning, situations leading to an overloading of sewage treatment facilities might be forecast and prevented. Further study would seem to be indicated as regards the elimination of some particularly toxic chemical effluents which have hitherto resisted treatment.

42. Attention should be drawn to some of the modern tools and methods to achieve efficient waste management as they were emphasized in document ENV/CONF/G.4/Add.1, including rationalization of effluent charges, achieving of least-cost waste treatment under alternative programmes, extension of collective measures for water quality improvement, etc.

43. As to solid household refuse, its storage in paper or plastic sacks seems to be the most promising development and should replace the traditional dustbin; otherwise, mechanical dustless loading becomes indispensable. For the disposal of any solid waste, controlled tipping and composting might be the cheapest satisfactory method, particularly if connected with some pre-treatment.

44. In general, production processes making less waste should be encouraged. New products should be accepted on the market only if capable of being eventually reintroduced into the natural and industrial cycle. Instead of disposing of waste, the recycling of waste materials should be aimed at and such a process should be recognized as an important means for preserving the dwindling resources of many raw materials. Co-operation between industry and governments in seeking solutions to waste disposal problems will become indispensable. Also, more resources will be needed for research into waste management economy. Statutory requirements for, and controls of, refuse collection or disposal, as well as appropriate standards of refuse disposal, should be promoted.

45. A special policy would seem to be needed as regards the disposal and elimination of derelict vehicles: the cost of its disposal and conversion into industrial scrap might be included in the price of the car.

VII. Agriculture, forestry and fisheries

(D.7 and D.7/1 (the latter in English only); see also E.3 and E.3/1; for agricultural effluents, see D.6 and for health aspects, H.5)

46. Agriculture and forestry are exceptional among economic activities owing to the fact that they determine the character of large portions of the natural environment by cultivating them for the production of food and of some raw materials. Based on biological processes, these industries tend to increase their output by stimulating these processes by means of mechanical and chemical intervention. Large-scale farming and forestry exploitation continue to expand; while the crop yield is thus increased, the new techniques are based on an intensive use of chemicals and heavy machines and require land consolidation - all of which bears environmental risks. By these means, considerable parts of the landscape in the ECE region have been changed, changes which have often taken place to the detriment of the variety and equilibrium of the natural environment. In not a few areas, serious ecological disruption has occurred and irreparable damage to the natural environment has already been brought about.

47. In turn, agriculture, forestry and fisheries suffer from the environmental disfunctions generated by other industries. For example, air pollution caused by energy production and by the chemical industry is particularly detrimental to crops. Agrobiologists are seriously concerned about the slow but incessant build-up of toxic compounds in the soil. Pollutants by which the temperature of the water is modified, and the clarity and oxygen content of the water are reduced, are becoming increasingly detrimental to fish breeding. Mention should be made, for example, of the deleterious effects of pesticides upon fisheries in estuarine waters. The negative effects of dams in preventing the migration of valuable fish should also not be overlooked.

48. The natural disequilibrium caused by intensive farming and forestry has a feedback effect which is clearly felt in the declining output of these industries in some areas. Massive reduction of the biological diversity resulting from modern farming and forestry, which tend to focus on the cultivation of a limited variety of crops only, has detrimental effects, in the long run, on, *inter alia*, the monocultures themselves.

49. Modern farming has, in many regions, exercised a profound impact on society. A very great number of country people released from agricultural production have abandoned the countryside and, as urban dwellers, they return, not to produce, but to enjoy recreation. The increasing human awareness of the need to preserve valuable natural sanctuaries and recreation zones from any intensive exploitation is certainly due, to a large extent, to this modern social phenomenon.

50. Among the specific noxious effects of industrialized farming and forestry, the following would deserve mention via exempli:

- (i) disruption of the ecological, climatic and geological equilibrium and reduction of the genetic diversity of plants and animals; soil erosion, degradation and pollution; the expansion of arid zones and areas affected by excessive wind turbulence; plant nutrients from soils, animal wastes and fertilizers have contributed to locally serious problems of eutrophication (excess aquatic plant growth) and to nitrate contamination of ground water supplies; saline irrigation drainage waters are an important problem in arid areas;
- (ii) noxious effects on human health owing to
 - the manipulation of machines and over-intensive use of chemical agents such as fertilizers, pesticides, herbicides;

- the disposal of large quantities of manures from intensified animal breeding;

(iii) degradation of the recreational and aesthetic quality of the landscape by the expansion of consolidated farmland, and penetration of clumsy agricultural constructions into zones of natural beauty.

51. As regards environmental action, the need is increasingly felt for governmental support to ensure the preservation of the most essential features of the rural environment. While the environment should be protected more efficiently against damage caused by modern agrotechnics, biological production in itself would require more systematic and efficient protection from environmental nuisances caused by other industries and activities. For these purposes, comprehensive and long-term planning measures are indispensable both on the local and regional levels. It seems that only in this way can an appropriate, sound and well-balanced land-use and cultivation programme be achieved and land consolidation projects aimed at a more intensive land cultivation can be brought into harmony with recreational, cultural and biological interests.

52. More knowledge is needed about the long-term effects of human interventions in the natural substance and the traditional ecological balance. Environmental disruptions could be prevented if we knew how to create a new, satisfactory balance of ecological factors in areas where the landscape has undergone far-reaching changes owing to farming, building and other human activities. Serious attention should be given to the continuing destruction of genetic resources resulting from the diminishing of genetic varieties by selective plant breeding.

53. Better co-ordination and control will be needed as regards the protection and utilization of areas of natural value and scenic beauty.

54. The more specific actions in the sector of agriculture, forestry and fisheries might include measures aimed at, for example:

- improved storage of chemicals and improved safety of agricultural workers;
- the exchange of information about the effects of chemical agents;
- encouragement of the use of plant-protecting substances based not on toxic, but on biochemical effects;
- legislations allowing a proper control of agricultural wastes including, in particular, the disposal of waste products and manure from intensive large-scale animal breeding (feed-lots, pig-factories, broiler plants, etc.);

- protection of land from erosion by green belts and advanced farming methods;
- improved protective measures for game and wildfowl;
- protection of forests against visitors' vandalism and fire incidence by, *inter alia*, the zoning of forest land with regard to its productive and recreational roles;
- increased emphasis on the conservation and development of forests as a critically important environmental factor;
- intensified protection of waters inhabited by fish by increased fines to polluters;
- national long-term programmes aimed at a systematic amelioration of fish spawning and breeding grounds.

B. PROBLEM AREAS

55. All of the problem-areas which have been selected for discussion at the Conference present some major environmental problems. Although the conditions may vary a great deal from area to area, their common feature is that the problems encountered in them are the combined result of the accumulated individual environmental disfunctions many of which have been generated by the problem-sectors discussed - either within or outside the given area. The local or regional complex of environmental disfunctions is therefore more than just a combination of many individual nuisances. It represents rather a special environmental climate resulting from the mutual and lasting interaction of the numberless individual pollutants, noises, hygienic shortcomings, misuses of land, aesthetic offences and psychological stresses all concentrated in one area. Hence the need for comprehensive and long-term remedial action involving virtually all organs responsible for local development. Their close and systematic collaboration under a joint leadership providing for horizontal co-ordination is indispensable. Thus, in all types of problem-areas, such as those further discussed below, two major lines of environmental action would seem equally to be recommended:

- (i) administrative and organizational arrangements at the appropriate governmental level (municipality, district, region) providing a framework for a comprehensive and systematic environmental programme, and
- (ii) arrangements in planning and research aimed at safeguarding an efficient implementation and up-dating of such a programme.

56. Although international co-operation to this end would not seem to be generally needed, a number of environmental problem-areas exist where international joint action may become unavoidable owing to the proximity of national frontiers. More general international involvement would be desired as regards a systematic exchange of information on the environmental experience gained by the individual local and regional governments.

57. Since it is obvious that the above recommendations relate to any geographic area suffering from a bad environmental climate, they should be considered as being equally applicable to each of the problem-areas which will be dealt with in the following section. Therefore, no special further reference will be made in this respect.

I. Metropolitan area and region

(E.1; see also E.4 and H.7; for planning aspects, see H.1, H.1/Add.1 (French only) and J.2; for health aspects, see H.5)

58. Metropolitan regions have, as a rule, developed on the basis of ancient urban cores and industrial agglomerates whose economic power and attraction has provoked a more or less intensive urbanization around these growth poles. With excessive densities of population and infra-structure in their nodal parts, and with considerably reduced densities in their fringe areas, metropolitan regions combine quite variegated types of environment. These range from intensively built-up "mineralized" environments with completely artificial features and conditions, to semi-rural and rural areas where, in spite of being disrupted and handicapped, natural environmental components still prevail. Virtually none of the geographical sectors of a typical metropolitan region can be considered as virgin and unspoilt nowadays; only too often, disequilibrium of the natural environment, functional chaos, health risks and social instability inherent in the metropolitan structure have been paid as the price for priority industrialization, rapid economic growth and other favoured but one-sided benefits.

59. It is probable that in any larger metropolitan region most of the environmental nuisances enumerated under the individual economic activities will be easily identified. However, owing to the combination and intensive interaction of such nuisances, some new phenomena may also become apparent such as, for example, a persistent increased level of noise, a general reduction of ultra-violet radiation, an increased frequency of fogs and the occurrence of photo-chemical effects by which relatively high

concentrations of ozone are produced having a particularly damaging impact on vegetation. Moreover, the haphazard spatial distribution of activities, excessive local concentrations of population and the un-coordinated development of individual sectors have as a corollary an oversupply of roads and other items of built infrastructure by which open spaces and vegetation areas are reduced to an absolute minimum.

60. Because of an intensive economic competition, land for development is preferably sought in areas which yield some advantages or to which some special attraction is attributed by investors. Thus, the main flow of capital investment may be completely diverted from areas deserving renewal because of functional or environmental obsolescence.

61. Metropolitan regions are, by their very nature, aggregates of a number of individual communes and municipalities. Moreover, various interest groups, public and semi-public bodies with quite contradictory interests, as a rule abound. All this contributes to an unduly complicated decision-making pattern by which environmental interests must necessarily suffer. Where competitive behaviour among municipalities still prevails, a considerable imbalance may occur in the tax revenues and, consequently, expenditure on equipping individual areas of a metropolitan region may differ a great deal. Needless to say, under such circumstances, environmental benefits will tend to accumulate in some privileged areas, whereas, in others, neglect and deterioration may become unavoidable.

62. The complexity of environmental problems in metropolitan areas and regions make it imperative to adopt an overall long-term environmental policy, and to pursue its implementation through comprehensive development plans. Rather than push development, efforts should be made to gear, channel and distribute wisely the development forces available, in order to preserve an equilibrium between areas of concentrated activity and areas of outstanding environmental value. Programmes for protecting vegetation, biological balance and the landscape should be an integral part of such plans. While determining certain focal points and lines of further urbanization, such development plans for metropolitan areas and regions ought to combine various alternatives: the development of new towns and activity zones, the growth of selected existing settlements and the redevelopment of dilapidated parts of the metropolitan organism.

63. Although a reasonable choice should be offered for residential development, it would seem advisable to avoid an excessive spreading of low-rise housing if this entailed the inconvenience of having the remainder of the housing-stock squeezed into excessively high and dense residential units. Special attention should be given to the delimitation of areas suitable for second residences. The need for good interconnexions and mutual accessibility of working places, residences, service centres and recreational space over the whole region, should not be lost sight of.

64. The creation of industrial parks and zones with an appropriately co-ordinated transportation infra-structure, energy and water management, may contribute significantly to the cleaning-up of dilapidated mixed zones and to an elimination of noxious industries in areas of high residential value. However, efforts should be made to delimit reasonably the size of such individual industrial zones, to permit nature to expand within and around such zones and to avoid an excessive concentration of transport flows.

65. A comprehensive waste management system may contribute considerably towards making metropolitan environments attractive. An integrated transportation policy covering the entire metropolitan region, with due emphasis on an efficient mass transit system, may, to a much larger extent, ameliorate environmental conditions. Where individual car traffic cannot be banned, drastic measures for making both the moving and stationary traffic as unobtrusive as possible should not be shied away from. As many parts as possible of the metropolitan territory should again be made perfectly safe for the pedestrian; networks of paths and green spaces should be developed or completed encouraging walking, cycling, games and other physical exercise. This might reduce the danger of devastation of the generally scarce recreation areas available within the radius of such regions. At the same time, further development of a system of recreation areas for daily and weekly use would seem generally desirable. Compatibility should be sought between recreational needs, agriculture and forestry in the outskirts of metropolitan regions. For this purpose, a long-term assessment of the total benefits of each of these activities might be of advantage.

66. By implementing these and other environmentally protective measures, metropolitan and other urbanized areas hitherto abounding in environmental nuisances might be successively converted into "environmentally clean" areas. Such developments might

be favourably initiated and tested by taking environmental measures fully into account in plans for new urban development. There is no doubt that, once environmentally clean cities or zones have been built on an experimental basis and proved both economically feasible and successful, such examples would provide major incentives for similar action in old established metropolitan areas.

II. River basin

(E.2; see also H.7, H.10 and J.3; for liquid wastes, see D.6 and for planning aspects, H.1).

67. Because of their specific geological, geographical and biological features, river basins constitute, as a rule, more or less clear-cut ecological entities in which certain interactions between the individual environmental elements occur more frequently and in a more intensive fashion than anywhere else. River basins therefore present typical examples of environmental units the development and exploitation of which should proceed in a co-ordinated and careful manner. Distinction should here be made, in this respect, between downstream (tidal estuaries) and upstream (flowing rivers) in which the environmental problems may considerably differ from each other.

68. Any river basin with the water horizon remaining on a satisfactory level throughout the year and in which the danger of frequent and excessive floods has been eliminated has exercised a particular attraction for many human activities. Consequently, suitable sites along river basins have been preferentially urbanized and industrial development has been particularly intensive mainly along the downstream banks. Apart from serving as an indispensable resource for most of the industries, water in river basins has always been used as a medium for the many types of waste discharged by these industries. Simultaneously, rivers served irrigation purposes and have more recently been increasingly exploited for hydro-electric energy production. Moreover, navigable waterways which have been used from time immemorial for transportation, have continually expanded thanks to incessant regulation of rivers. Gravel is being extracted from river beds on an industrial basis. At the same time, fishing is still considered as a legitimate commercial activity on rivers and streams.

69. It is clear that many environmental conflicts must emerge owing to the numerous and contradictory demands on rivers, and on whole river basins. Among those most apparent, the following can be mentioned:

- (i) damage to biological life in rivers owing to
 - the excessive use of waters for industrial purposes and to excessive discharges of insufficiently treated or untreated waste water from industries and urban agglomerations (toxicity, over-fertilization of the aquatic ecosystem);
 - an increasingly dense transportation system by which major disturbances are caused by oil pollution, the accidental discharge of toxic chemicals, and noise;
 - the dredging of sand and gravel;
 - elimination of marshes;
 - recreational boating activities (motorboats);
 - use of chemicals for agriculture, which are drained into river streams;
- (ii) degradation of the quality of water used for household purposes;
- (iii) lowering of ground-water horizons, disruption of ground-water balance and contamination of ground-water resources;
- (iv) washing down of fertile soil layers owing to a rapid draining-off of rain water;
- (v) spoiling of the river basin landscape by an over-exploitation of river banks for production, storage, transportation and waste disposal, and by unsightly constructions;
- (vi) malodours, foam and other nuisances caused by untreated residential wastes, chemical effluents, dead fish, etc.

70. If decisive improvements in the environmental quality of river basins is to be achieved and their utility for beneficial uses fully restored (for example, for public and municipal water supplies, industrial water supplies, agricultural water supplies, commercial and sport fishing, water contact recreation, reasonable recreational boating, propagation of a wider variety of aquatic life and wildlife), the following measures would have to be applied:

- the clear definition of environmental quality and special ecological objectives;
- the identification of the most noxious activities and the most important sources of pollution;
- the imposing of tolerable limits of pollution calculated on the basis of the average self-purifying capacity of rivers and streams;

- the development of comprehensive river basin management programmes adopting a zonal concept and including, inter alia, projects for a co-ordinated water supply and liquid and solid waste treatment, measures for flood control and land erosion control, plans for water treatment and cleansing, and prosecution procedures.^{4/}

71. It has been revealed that, for efficient river basin management programmes, aimed at reversing the ecological and other environmental damage inflicted, mathematical models capable of simulating the effects of various pollution loads and water manipulations might be outstandingly useful.

III. Countryside region attracting mass tourism

(E.3 and E.3/1; see also D.7, D.7/1 (English only), E.1 and E.4; for health aspects, see H.5 and H.6, and for planning aspects, H.1).

72. With the ever growing proportion of population settled in urban and metropolitan areas, and with the increasingly crowded and denaturalized environment in such areas, man's search for temporary relief, for a quiet rest and counter-balance to everyday stresses, has brought him to a reappraisal of the natural countryside he once had abandoned for easier city-life. Improved transportation, expanded leisure time and generally rising standards of living have, in the recent past, enormously facilitated, at almost any season, travel, tourism and access to recreational areas of large masses of the population. This has occurred to such an extent that the periodic influx of population to zones renowned for their recreational qualities, and the consequent development boom resulting in an urban-like and quite chaotic built infra-structure, tend to downgrade the exceptional values for which these zones were reputed. Both the individual's striving for a favourably located second, and maybe third, residence, and organized mass tourism have played their part in this development.

73. Tourism has become an industry which is busy exploiting what may be called "non-economic amenities" such as an outstanding climate, natural beauty, and cultural and architectural heritage, etc. The exploitation of such amenities, however

4/ In this context, attention is drawn to, inter alia, the recommendations concerning management of river basins adopted at the related 1970 ECE Seminar in London (ST/ECE/WATER/3).

beneficial for man's health and cultural experience, is, as a rule, organized on economic principles too narrow to allow of an adequate and comprehensive management of tourist and recreational zones. The previous amenities, both natural and man-made, are facing gradual destruction both because of the initiative of the modern tourist industry and because of the neglect and indifference shown by some sections of the public. Moreover, various industries tend to develop showing too little respect for delicate landscape features, biological, climatological, geological and cultural values which, once destroyed, can almost never be restored again.

74. In the ECE region, organized, as well as non-organized, tourism has, for a long time, been an international affair. Although virtually no country has been exempted from mass movements of holiday-makers who do not recognize national frontiers, and no country can afford to disregard the obvious economic benefits and give up competition for tourist markets, it may be fair to state that southern European countries, and the northern Mediterranean area in particular, have gained increasing preference in this respect. Particular zones and regions have developed, the economic structure of which has been streamlined and expanded in a spectacular manner in order to meet the requirements of the tourist industry and to share in its profits. Although the positive sides of such development (both for the population of the formerly under-developed regions and for the tourist) must not be overlooked, the negative consequences, which are becoming ever more apparent, should gain at least equal attention and should be forestalled by a well organized system for environmental protection and care.

75. Among the measures which seem to be more or less generally needed for and applicable in recreational areas for which mass tourism has a preference, the following may be stressed:

- defining and delimiting regions, areas and focal points of priority tourist interest;
- carefully evaluating the attractiveness of the individual areas and of their maximum permissible receptive potential (point of saturation);
- defining an appropriate balance, in such regions and areas, between recreational and tourist activities, on the one hand, and agriculture and other economic activities, on the other hand;

- determining areas for priority larger-scale development of tourist accommodation and of ancillary facilities and the establishing of plans for making such development compatible with environmental interests;
- determining areas where development may take place but will have to observe special constraints regarding the permissible density, height, traffic accessibility, use of building materials, location of non-recreational facilities, etc;
- developing standards and conditions regulating spontaneous individual private development in recreational areas;
- setting out measures countering excessive land speculation and the resulting disorders in the development and use of recreational areas;
- de-blocking the accessibility of certain areas which may constitute the main elements of the tourist attraction and where the danger of destruction is not significant or can be countered by appropriate management and maintenance (for example, natural coastal amenities);
- banning or allowing limited access only to natural "sanctuaries" of an outstanding, biological, geological or other scientific and cultural value in which any building intervention or general accessibility might cause unfavourable changes or irreparable damage;
- developing special protective measures (including funds serving the restoration of environmental qualities) in areas of special scientific and cultural interests;
- putting into effect hygienic measures and regulations in respect of sanitary equipment and public health in recreational areas.

IV. Industrial region

(E.4; see also E.1, E.2 and H.7; for planning aspects, see H.1, H.1/Add.1 (French only) and J.2. Reference should also be made to studies dealing with industrial sectors (series D)).

76. There is much similarity between the environmental dysfunctions encountered in large urban and metropolitan regions, as discussed in section I of the present Chapter, and those being faced in regions where industry, and heavy industry in particular, has occupied a particularly prominent place. However, in addition, some special dysfunctions arise which must be attributed to the exceptional scale and locational monopoly of industries implanted in such areas. Such a development has

had, as its corollary, a considerably reduced proportion, or even absence, of other sectors and activities and of the manifold related facilities and amenities. Environmental diversity has thus shrunk considerably. Although the industry, in itself, may be quite diversified, an overall monotony, with industrial constructions and auxiliary edifices dominating both the local scale and the regional horizon was the frequent result of the absolute predominance of industry in some regions. As a rule, nature has been the major victim of industrial expansion in these regions and the very sparse remnants of biologic life, in rivers, in the air and on the land, have been limited to species which have survived owing to their particular resistance to pollution and/or to other industrial nuisances.

77. Although, in a number of cases, quite spectacular improvements have recently been achieved as regards certain environmental qualities, such as air cleanliness, the rehabilitation of mining areas or the water purity of certain streams, extensive industrial zones and whole regions still persist which may be considered as representing the farthest reaching and most complete degradation of the environment that man was ever capable of producing.

78. An over-concentration of certain types of production based on primitive economic assumptions; outdated technologies and production processes having as a result excessive quantities of wastes in terms of solids, gases, liquids, effluents and heat; a lack of spatial co-ordination of production; and disorganized land-uses resulting in an "economic and spatial chaos" - these may be considered as some of the main reasons for the comprehensive environmental degradation of industrial areas.

79. Environmental disorders generated by the various industrial sectors implanted in industrial regions have major negative repercussions on these sectors themselves, repercussions which are both direct (for example, lack of sufficiently clean air and water needed for certain technological processes, corrosion of constructions; destruction due to land subsidence; disruptions of energy supplies, etc.) and indirect (elevated morbidity rates among industrial workers, excessive commuting from residences in less polluted areas, etc.). Moreover, other sectors also suffer: agriculture and forestry in border areas (for example, through pollution and the disturbance of water systems); recreation; transportation in general (smog, disruption of transportation networks owing to geological changes, diseconomies owing to interrupted traffic flows), etc. The landscape has suffered here from some of the most comprehensive

environmental deterioration ever encountered. This has happened particularly in areas where coal processing, energy production, metal production and the chemical industry have developed in the vicinity of old mining sites. Filling-sand mines, quarries for limestones, dolomites, building and ceramic raw materials, open-cast coal workings, debris from the mines, deposits of ferrous and non-ferrous metal ores, slag-heaps from energy plants etc. - all these elements not only contribute to the disfiguration and dereliction of the landscape but are also easily subject to wind erosion.

80. If meaningful and overall environmental improvements are to be achieved, an appreciably comprehensive set of measures regarding emissions, wastes, land restoration, production, modernization, land-use etc., embedded in large-scale long-term development plans, will become inevitable. It must be taken into account that some of the components of the industrial infra-structure, as well as the plants in themselves, belong among the most expensive ones. They represent capital investment with relatively long amortization periods and therefore capable of only stage-wise modernization within long-term periods. Because of the rather long time and extra-ordinary resources needed for the comprehensive modernization and reconstruction of industrial regions, an efficient co-ordination of investments over a considerable span of years will be imperative. However, more immediate and efficient measures, such as the relocation or switching of production, may be possible in cases where the enterprise concerned is less dependent on the built infra-structure and is more flexible.

81. A systematic and periodically updated inventory of all major productive and non-productive elements and activities in the region, and a monitoring of environmental disfunctions may help to identify the major problem-spots and changes which tend to aggravate the situation. While the modernization of old-established industrial plants, and the introduction of land-use modifications and corrections in ancient industrial zones may meet with difficulties, everything should be done to eliminate noxious productions which resist modernization and to avoid additional environmental nuisances arising in new production units and auxiliary installations.

82. Particular care will have to be devoted to recreating satisfactory living conditions and non-industrial activities in areas where workers' residences are concentrated: protection against soil subsidence, disruption of energy and water supply systems; the development of green belts, easy access to recreational areas; the priority siting of schools, hospitals and other facilities on well protected

sites - these are some of the possible measures to improve life in industrial regions. Special enterprises should be developed to take care of a systematic elimination or rehabilitation (by means of landscaping, re-afforestation and other planting, etc.) of excavations and dumps. The same refers to the need for efficient waste management where efforts made by individual industries must be complemented and harmonized by means of local government intervention.

83. Great emphasis should be laid on the development of research stations conducting research needed for defining efficient measures aimed at improving the industrial environment.

V. Zones of historic value and interest

(E.5; see also E.3, H.1/Add.1 (French only) and F.16; for building aspects, see D.4 and H.1/Add.2 (Russian only), and for planning aspects, H.1 and J.2).

84. While a "hard core" exists of buildings and zones of historic and artistic value and interest (lists of those officially recognized as protected monuments have been set up in virtually every country), there are reasons to believe that this fact in itself, and the underlying activity focused on the conservation and protection of monuments, are far from providing satisfactory solutions to the problem of an appropriate management of all the valuable heritage from the past. First, the real scope of edifices and zones of historic value and interest is much wider than that which is reflected in the official lists and backed by meaningful subsidies from governments and foundations. Second, the inventories and subsidies available fall considerably short of the real needs for resources. This statement is based on the assumption that, in principle, whatever has been preserved from the past and is capable of raising sufficient interest because of its undeniable artistic, historical, scientific and environmental values, should not only be kept in good condition, but should also be integrated, to the greatest extent possible, into contemporaneous life.

85. It seems fair to state that environmental considerations and concerns, which have been added relatively recently to the more traditional appraisals of artistic and historiographic values, have contributed significantly to the expansion of the notion of a "zone of historic value and interest". Ambient structures and spaces of historic origin in which the officially recognized monuments are organically incorporated, gain support and appreciation, notwithstanding their much poorer individual qualities. The

discomfort and alienation increasingly felt by residents of high-rise and emotionally sterile modern housing estates have contributed to the widened interest in historic environments as does the ever expanding tourist industry.

86. However, with the notion and scope of the valuable historic zones considerably widened, it becomes increasingly difficult appropriately to define and delimit them. As a matter of fact, the time may soon come when any structure, space and amenity originating in a pre-industrial period of construction will be considered worth preserving. Instead of strictly artistic and historical criteria, the mere fact that such built environmental elements are devoid of up-to-date equipment and that their image differs from anything modern building technology is able to offer, will suffice.

87. Given this situation and the increasing necessity for people to preserve their links with the paleotechnic and emotionally wealthier past, it seems most deplorable that their environmental options are challenged by their own economic preferences. Because of the tremendous economic pressures on valuable urban space, and because of the huge technological capacity available to our society, the further existence of the remnants of the past seem to be threatened more than ever. Virtually every day ancient structures disappear giving way to new roads, parking spaces, commercial establishments, etc. and in almost any city an impressive list can be established enumerating examples of environmental damage and of more or less lasting obstructions caused to the historical heritage. If not destroyed, old structures are often depreciated by misuse, neglect and abandonment. And even where resources for conserving and protecting sites of historic value and interest have been raised, these may suffice for a temporary preservation but frequently are quite inadequate for giving old structures a more lasting new life and an appropriate new function. The fact that contemporary society is capable of doubling its numbers in less than four decades and that the total output of the building industry up to the end of the century may more than double the built infra-structure hitherto existing, must make us aware of the scope of environmental changes that existing cities will have to face.

87. If, despite all the changes and pressures to come, man still decides to preserve what he has found to be an attractive, valuable and irreplaceable heritage from the past, the measures needed to achieve this end will have to penetrate all levels and sectors of decision-making and will require considerable sacrifices and resources as well. Such measures ought to include, inter alia:

- actions aimed at a more comprehensive inventory and at a comprehensive environmental evaluation of ancient structures and zones presenting, for various reasons, an interest to contemporary society;
- research aimed at determining indicators of environmental quality by which the value and nature of such areas could be more reliably assessed and expressed in terms of socio-economic benefits and thus made comparable to alternative possible land uses in the areas concerned;
- an international exchange of experience in evaluating historic structures and zones;
- projects which would enable an appropriate set of measures to be put into effect, including conservation, protection, redevelopment and new organic development in areas of such environmental interest;
- measures to ensure an adequately rapid and efficient implementation of the above-mentioned projects and to enable incompatible forms of development to be blocked or arrested altogether;
- measures enabling sufficient funds to be created for public intervention in areas of historic value and interest.

88. Attention is drawn in this matter to the appreciable amount of work carried out by a number of international organizations.

C. DISCUSSION PAPERS

I. Government policies and strategies relating to environment; long-term governmental objectives, procedures and operational planning; national legislation

(F.1, F.2 and F.3; see also C.4, G.3 and the report of the 1970 ECE Meeting of Senior Governmental Advisers on Environment E/ECE/ENV/2).

89. Environmental qualities should be looked upon as a vital part of the standard of living or "welfare". From this it follows that environmental dysfunctions, whenever they imply a sacrifice of some components of human welfare, represent a socio-economic cost.

90. Although improvements of the environment should therefore be considered as values added to human well being they will, given present technology, require a certain sacrifice of other components of the standard of living, mainly as regards material consumption. Obviously, the major task for governments then is to attain an optimal combination of material consumption, on the one hand, and environmental qualities, on the other. In other words, governments have to aim at the optimum allocation of resources (including common property resources such as air, water, etc.).

91. An optimum solution of the basic resource allocation problem calls for the clarification and setting of major environmental objectives to which environmental policy measures would be adjusted. A balanced and comprehensive system of information is needed by governments so that a rational decision can be reached about the nature and amount of resources to be devoted to environmental improvements as a whole, and about those environmental disfunctions and projects which deserve the highest priority.

92. At the Meeting of Senior Governmental Advisers on Environment which was held in Geneva towards the close of 1970 pursuant to ECE resolution 7 (XXV), delegates gave preliminary consideration to the above topic and identified a number of issues of particular importance or suggested elements of solutions to problems which nearly all ECE countries face in common. These are contained in the Report of the Meeting of Senior Governmental Advisers on Environment (E/ECE/ENV/2), the relevant excerpts of which are reproduced below.

93. Delegates to that Meeting concluded that while many positive steps had already been taken by most governments, much more had still to be done to clarify governmental objectives and options and to adopt a satisfactory pattern of priority actions in the environmental field. More specifically the Meeting of Senior Governmental Advisers considered that the following were some of the principal issues on which government policies might concentrate:

- (a) "how to develop environmental standards and regulations concerning the allocation and manner of use of natural resources, the production methods and outputs in all sectors of the economy, the interference of man with natural systems, and the ways and means by which built environments are created, changed and maintained;

- (b) "how to establish pricing, taxing and subsidizing policies in support of environmental objectives (for example: by including the costs of environmental improvements in the prices of goods of which the production has caused environmental damage; or by providing incentives to producers and consumers to stimulate innovations and new techniques which are less harmful to the environment; and by considering whether those who cause pollution or other environmental deterioration should pay for the costs of restoring the environment);
- (c) "how to set comprehensive and systematic fiscal priorities aimed at improving the environment, based upon sufficient information with regard to costs and the effects of alternative policies, as well as upon knowledge of the values and benefits of improvements;
- (d) "how to provide adequate resources for infra-structural improvements and public goods of high cultural, ecological and/or leisure value;
- (e) "how to develop and implement physical development and land use plans - also on the regional and national levels - which would properly take into account environmental objectives and which should be properly merged with other economic, social and environmental plans and policies;
- (f) "whether to put more emphasis on preventive measures;
- (g) "how to harmonize policies internationally by means of co-operation and agreements - bilaterally, sub-regionally and regionally - where this would seem to help enhance the efficiency and quality of environmental measures within the ECE region; such activities of the ECE should be closely co-ordinated with the work of the other international organizations concerned;
- (h) "what share of the national income should be devoted to improving progressively the most threatened segments of the environment, noting that a higher priority for environmental improvements should - in developed countries, at least - be harmonized with the goal of economic growth, but that environmental policies could be integrated in the economic growth concept which ought to be broadened accordingly."

94. Some further considerations may be added to these points. Experience tends to show that a fragmented policy in environmental matters leads to gaps in some areas, to overlapping in others and, not infrequently, to failure. In particular, measures

confined to too small an area, affecting too few economic sectors, and chosen from a too narrow set of alternatives may often turn out to be ineffective and expensive. What seems to be required is comprehensive and balanced information about the ecological, economic and social consequences of all alternative measures, and thus the development of a system of environmental objectives, policies and priorities. But this would ideally require knowledge about the costs and benefits of all alternatives, and it would be necessary for this knowledge to be made available to all those who, directly or indirectly, contribute to the decision-making. Obviously, such information does not exist at present. Nor should the lack of complete information be used as an excuse for inaction on urgent problems (only a small part of the information already available is actually used as a basis for action). It is possible, nevertheless, to develop procedures by which those who set the objectives are made aware of the often far-reaching consequences of their actions. The selection of such procedures could be supported by using modern analytical tools, including, for instance, simulation models.

95. But more than that, it is also necessary, in many cases, to redevelop existing legislation towards a more integrated and multi-disciplinary approach. Legislation dealing with limited objectives is often inadequate and out of date because the causes of environmental degradation can no longer be treated as isolated phenomena. They occur simultaneously, interact on one another and, in consequence, may best be treated within a comprehensive system of policies and priorities.

96. Another step would be the laying of particular emphasis on such policies as lead to "built-in" environmental improvements. A better environmental education and a better knowledge of the effects of environmental disfunctions upon human welfare may lead to such a dynamic environmental improvement. Moreover, such step as a system of progressive charges upon those who pollute, and/or a system of incentives and rewards for those who develop non-polluting and improving technologies, might be emphasized more than in the past, whereas over-rigid standards and regulations which have been very much emphasized in the past, may, in many cases, lead to non-optimal situations and become rapidly outdated.

97. Thirdly, international arrangements to grapple with the supra-national environmental problems may be reconsidered, with the aim of improving the information about objectives, policies and priorities of Governments in the ECE region, and possibly also with the aim of harmonizing the approaches where such a harmonization would lead to a more efficient improvement of the environment and a better allocation of resources in all countries concerned. Procedures might eventually be evolved for dealing with conflicts which might arise with regard to the impact of environmental problems going beyond national frontiers.

II. Organizational and institutional arrangements, procedures and operating measures at different government levels

(F.5, F.6, F.7, F.13 and F.14; see also C.4 and E/ECE/ENV/2).

98. Many unsolved environmental problems testify to shortcomings in resource management. Up to the present time the approach to environmental management has been too sectoral and piecemeal. Recently, many governments in the ECE region, having begun to take more comprehensive views, are in the process of reorganizing their administrative machinery relating to environment. Thus in many countries the picture is one of transition towards strong machinery. In many instances, however, governments are not yet in a position to apply well tried methodologies and solutions to environmental problems. A great deal of work remains to be done, nationally and internationally, to further improve and strengthen the management of the environment.

99. At the 1970 ECE Meeting of Senior Governmental Advisers on Environment, the following summing-up of the debate by the Meeting's Vice-Chairman was given (as recorded in paragraph 31 of the Report):

"It was recognized that, while some most encouraging organizational innovations had already been achieved with respect to the **comprehensive** protection and development of the environment, for the most part, countries were still in a transitional stage seeking arrangements to suit their particular internal governmental structures. At this stage of the work, it was considered premature to attempt to formulate a firm overall recommendation which would be appropriate to all cases, but it would already seem possible to set out some essential factors which might feature in whatever solution were to be considered, namely:

- (a) "governmental arrangements at the central level should be headed by a cabinet member or high-ranking official of equivalent importance, in order to provide an effective voice and leadership in the governmental decisions which are being made daily, many or most of which affect the environment;
- (b) "the central body itself should preferably co-ordinate and promote decisions and should not be confined to an advisory role; it should include operational control and planning functions as well;
- (c) "such a central body should (i) have a comprehensive and systematic approach and both a short- and a long-term outlook; and (ii) have wide contacts with universities, research institutes, etc., so as to ensure a continuing flow of the necessary information and research results required in decision-making, and also provide for a feed-back system;
- (d) "the central body should maintain close lines of communication with local and intermediate authorities, so that all efforts would be well co-ordinated; furthermore, the body should maintain close contacts with and encourage participation by citizen groups and the population at large;
- (e) "wherever applicable, the governmental arrangements covering the intermediate (regional) and local levels should be strong enough to cope comprehensively and systematically with specific environmental problems arising in individual regions and urban or rural areas; this need would best be served by establishing a special post (or organ) at the appropriate intermediate or local level, to which would be delegated the authority and resources needed for bearing extensive environmental responsibilities, undertaking multi-disciplinary studies and organizing and co-ordinating comprehensive environmental action on those levels."

100. It would seem appropriate for the Conference on the basis of additional documentation presented now to endorse the tentative conclusions reached by the Meeting of Senior Governmental Advisers on governmental organizational arrangements for dealing with environmental problems.

101. Furthermore, the Conference may also wish to consider certain other aspects of these arrangements. One important issue in this respect is the education and training of governmental civil servants dealing with environmental problems. It

seems desirable to take into account, more than was done in the past, the complex nature of environmental problems and policies by hiring civil servants from various disciplines who are trained in inter-disciplinary work and who are provided with the opportunity to update and expand their knowledge by attending on a regular basis, throughout their career, courses, seminars, etc. This is also a necessary measure for ensuring close contact between environmental research and environmental management.

102. The task of the provincial and local authorities should be fully integrated and supported at the central level. On the other hand, the prevention and solution of many environmental problems depends on close contact with the people and areas concerned. These two aspects may cause difficulties in determining the optimal jurisdictional boundaries of a provincial and of a local administration, as the first may require a larger area than the second. Furthermore, the effectiveness of local authorities is usually a function of their traditional political and fiscal independence, while the complex nature of many problems of larger than local relevance would require an integration of many environmental policies in comprehensive national planning.

103. This last point deserves special attention. There exists a need for stronger co-ordination of institutional arrangements, control measures, information systems and research projects and findings. The major co-ordinating links should occur between: land use, regional, urban, transport planning, on the one hand, and control of environmental dysfunctions on the other; between environmental research on the one hand, and environmental management on the other; between environmental planning, on the one hand, and economic planning on the other. The normal co-ordination within sectors often also needs improvement. However, not everything needs to be (or can be) co-ordinated; more study on this question is indicated. Special steps should be taken to harmonize environmental control measures in federal countries.

III. Environmental research; diffusion of knowledge; training in environmental disciplines; public education, information and participation

(F.8, F.9, F.10, F.15 and F.16; see also C.5 and H.3)

104. There are many academic branches dealing in one way or another with the environment. However, only a few efforts are being made to establish standing inter-disciplinary research teams, which would deal in a systematic and comprehensive

way with the nature, causes, remedies and preventions of environmental disfunctions. Furthermore, many of the research projects under way in the field of environment are not based on all the existing knowledge, and do not result in new knowledge of such a nature that the results could be usefully applied in environmental decision-making in the foreseeable future. Finally, many research results are presented in a language and in a context not comprehensible to those responsible for environmental decisions. In short, efforts have to be made to improve the management of environmental research with the aim of receiving results which help governments to handle the problems more systematically and more efficiently. In particular, better knowledge is urgently needed on the effects of environmental disfunctions upon human and social welfare, on the benefits of environmental improvements, on the various economic, social and ecological side effects of disfunctions and measures, and on the relative efficiency of alternative policies and institutional arrangements. Much of this research should be financed on a longer-term basis which would not depend on annual appropriations.

105. As so many traditional and new disciplines are involved in environmental research, as various institutions produce research results in vast amounts (only some of which may be useful for environmental management), and as such manifold ways exist in which certain research results can be applied, the efficient diffusion of environmental knowledge has become a complex and difficult management task which has not yet been solved satisfactorily anywhere. Further clarification is needed about the pattern of information consumers, the pattern of information sources, and the relationships between the two patterns. Modern information and documentation technologies have to be applied to ensure that governments, research institutions and the general public receive the proper information when they need it. This would also create a greater awareness of environmental problems and promote behaviour patterns in responsible agents and the general public which would lead to effective environmental management.

106. Because the treatment of environmental disfunctions cuts across so many environmental disciplines, it may be difficult to provide a proper training for environmental administrators and other "environmentalists". No single profession can claim a monopoly in dealing with environmental problems, while all other academic branches could usefully provide some supporting knowledge. In fact, however, it may

turn out to be impossible in the short-run or even unwise to provide any special education and training with the specific aim of producing environmental experts with a comprehensive knowledge of the field. Perhaps governments should rather envisage an environmental training in various disciplines, and create new disciplines which could fill gaps in the traditional educational system (such as physical planning, environmental engineering etc.). More important than that may be the training for inter-disciplinary team work, and the periodic re-training of professionals working in the field of environment.

107. The need to improve the diffusion of environmental knowledge in the institutions of general education cannot be emphasized enough. In fact, this may be the major factor of long-run environmental policies. Only if all people are aware of their responsibility for keeping the ecological systems balanced, of the necessity to maintain and improve the quality of the resources of our "spaceship earth", and of the desirability to improve the social and cultural quality of life, only then can any environmental strategy be successful in the long-run. However, at present it is still unclear which information should most usefully be taught in schools, and how one should go about it pedagogically. Experience and the institutional basis are lacking.

108. Public information about environmental problems exists now in considerable quantities. However, one may get the impression that this information is biased towards certain particularly sensational issues, whereas the correct assessment of the implications of environmental disfunctions affecting the welfare of each citizen and the discussion of alternative remedies and preventions is still largely lacking.

109. The question of public participation represents the crossroads of two major policy issues of our time, the need to improve the environment and the need to make decision-making more democratic. Clearly, there are many aspects of environmental improvement which lend themselves particularly to public participation, and there are various ways in which the public can participate in improving the environment. The most direct way of public participation is through volunteer work teams, clubs, unions etc. which actively work in the environmental field. Another way is the broad participation of the public in environmental decision-making, be it by direct referenda, or by opinion polls and other indirect methods. The major problem here is the provision of sufficiently complete information to all groups of society in a way which can be understood generally so that all are able to make the choice that is in

the best interest of any individual, as well as of society as a whole, including future generations. Furthermore, one should mention the efforts to give the general public a better chance to intervene and to prevent any action which has been clearly proved to be detrimental to the environment.

IV. Financial, fiscal and other economic measures and policies including subsidies and compensation

(F.11 and F.12; G.2, G.3, G.4, G.5 and G.6)

110. Economists have only recently begun to study environmental issues and policies comprehensively. Their tools and instruments are still rather weak, and their approaches are incomplete. Yet they have been able to discuss and clarify a number of problems and issues of high importance for environmental management.

111. Economic evaluations require a large amount of qualitative and quantitative information. In particular, they are based upon the availability of indicators of the present environmental condition, of the cost of environmental maintenance at present levels, of the costs (and other adverse consequences) of environmental abuses and shortfalls, of the costs of achieving environmental improvements at various levels, and of the benefits of achieving environmental improvements at various levels. Until now such information has been scarce and random, and in many cases, appropriate techniques for collecting and evaluating information of this nature has not yet been developed. On the other hand, it is obvious that information and evaluations of this nature are a prerequisite for achieving a more rational allocation of resources.

112. In addition to the fundamental resource allocation aspect of the environmental policy problem, there are other aspects worth considering. Environmental policy objectives may conflict with general economic policy goals. It may prove difficult to avoid certain inflationary effects and possibly also strains on the balance-of-payments. Such strains on the balance-of-payments are likely to appear in particular whenever a country is running ahead of other countries as regards environmental policy objectives, but it is also conceivable that less developed regions with very old or infant industries dominating the economy will have considerable balance-of-payment problems. Apart from this, certain areas may face conflicts with employment and income distribution goals when trying to pursue environmental policies, but it may also occur that certain areas can only attract new economic activities if the environmental

quality is high enough to make the living in that area pleasant. All these employment and trade problems, however, should be subordinate to the basic resource allocation problem. To avoid confusion and to minimize the risks of policy mistakes they should not be allowed to be in the forefront of the debate.

113. There is a widespread opinion now that it is the responsibility of governments to improve the environment. Individual enterprises and households tend to produce and consume goods and services disregarding in many cases the negative effects of their production and consumption on the quality of the environment and, in particular, on such common property resources as air, water, soil, landscapes, ecological balances, beautiful designs etc. It is up to governments to correct this situation and to provide incentives for those who improve the environment, and disincentives for those who cause environmental disfunctions.

114. There are several environmental policy methods to hand, the most important being regulations, fees and subsidies. There are reasons to believe that a "policy mix" of all these is advisable. However, most of the socio-economic arguments are in favour of the fees method whereas there are weaknesses especially in the subsidy methods, at least as far as they are not used mainly to check the unwanted effects on employment and income distribution of regulations and fees. The fee method has great potentialities when it comes to giving producers and, indirectly, technicians, product designers and researchers, incentives to find new techniques and new products with comparatively few, or even no damaging effects upon the environment.

115. More systematic analysis is clearly necessary to provide governments with information on the whole range of policies, on the advantages and disadvantages of each alternative measure regarding environmental problems and objectives, and on the inter-relationships between the problems, the objectives and the measures. It already seems clear, however, that an allocation of resources which is satisfactory from the environmental and indeed the general point of view can only be reached through comprehensive and systematic economic evaluations of the alternative projects, measures, procedures, policies and strategies.

